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Tytuł pracy: Quantitative evaluation of the AI based image enhancement method applied to PET images acquired with a reduced acquisition time.
Temat:
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Abstrakt:
This study aims to evaluate the performance of deep learning enhancement (SubtlePET™) method in PET images reconstructed with a shorter acquisition time, different reconstruction algorithms. Impact of the enhancement on the clinical decisions was also assessed.
Materials and methods. 37 subjects (21 males, 16 females, mean age: 67 years, age range: 16-80 years, mean body mass index: 25.2, at least 1 FDG lesion) underwent clinical whole-body PET/CT exams using [^{18}F] FDG with standard acquisition time 1.5 min per bed position. PET images were reconstructed with OSEM reconstruction algorithm using 66% (1 min/bed), 100% counts (1.5 min/bed), respectively. Images reconstructed from 66% counts were further enhanced using two different versions of the deep learning (DL) based software (SubtlePET™, Subtle Medical, Menlo Park, CA). Additionally, 66% counts images were reconstructed with QClear™ (GE, Milwaukee, USA) reconstruction and enhanced with version 2 of SubtlePET™. Volumes of interest (VOIs) of the lesions and reference volumes of interest (VOIs) placed in the liver, brain, bladder and mediastinum were drawn on the standard acquisition. Same lesions, VOIs and reference VOIs were also copied and reviewed on the AI-enhanced images. SUVmax values of the standard and AI-enhanced images were compared.
Results. 252 VOIs were identified (37 for each reference region, and 104 for the lesions) and drawn for standard images and AI-enhanced PET images (AI-enhanced with both software versions) and QClear™ images were AI-enhanced with version 2 of the SubtlePET™. SUVmax values on AI-enhanced images were lower than on standard OSEM, but in version 2 the difference was smaller (average difference for version 1 was -11.58%, for version 2 -4.48%, same for median and STD. For images reconstructed with QClear™, however, the AI-enhanced SUVmax values were higher (average +8.95%, median 6.12% and STD 18.88%) than unenhanced. For small lesions with lower SUVmax values – a decrease of SUVmax was much less significant when software version 2 was employed (for liver reference average -6.46%, for lesions average -5.59%). For lesions with SUVmax range 2.0 to 4.0 SubtlePET™ version 2 showed the best match to OSEM. In the qualitative assessment, no artifacts and good general diagnostic confidence was found in AI-enhanced images. However, the images enhanced with the version 1 were different from the original OSEM images – some changes were less visible (but still identifiable). SubtlePET™ version 2 produces more detailed (less smooth) images and showed almost the same quality as original 1.5 min/bed standard reconstruction (much better than 1 min/bed OSEM reconstruction).
Conclusion. AI-enhanced images can help accelerate PET acquisitions by 33% without compromising quantitative SUV values and image quality as compared to the standard duration acquisitions. The reported equivalence of images was found only in the upgraded

version 2 of the tested software.